tremendous strain is thrown on the sacroiliac joints, often greatly increased by assistants on either side of the patient bearing most of their weight on the patient's thighs. The joints are left badly sprained and at times chronically inflamed. In the same way, improper methods of dress, by inducing abnormal bodily posture, with its consequent embarrassment to the viscera, doubtless is an etiologic factor of importance in many cases of obscure backache. This question of posture is of vastly more import than I am able at this time to suggest in its bearing on various pains and aches, to say nothing of its influence on the general economy of the body.

The acute fevers, appendicitis and other conditions, often accompanied or ushered in with backache, have other such definite pathognomonic symptoms that little importance attaches to this feature in such diseases.

The pain from uterine affections is most often referred to the upper sacrum—"a dragging sensation, generally referred to the brim of the pelvis posteriorly" (Kelly), being the complaint of that most common of all gynecologic ailments, retroflexion. Diseases of the ovaries, testicles and rectum, as also excessive venery and pelvic inflammations, may direct pain to the sacral region. Speaking of the pains of pelvic inflammations, Kelly makes the statement, which it seems to me good philosophy to follow generally, where pain is concerned, that:

Inflammatory pain has a definite habitat. . . . The pain of inflammation is a fixed point; it is never in one place to-day and then at some remote part of the body to-morrow, one day in the shoulder and the next in the foot or calf of the opposite leg. . . . It is a safe working hypothesis to conclude that a patient who complains of a definite pain and who from day to day and week to week is definite in her complaint as to the character and seat of the pain, has some gross lesion.

It has been my aim to deal with those pains occurring in the lower dorsal, the lumbar and sacral regions—the commonest seats of backache. And it has manifestly been impossible to dwell on more than a few of the more typical examples. Schmidt, in his discussion of lumbar pain, says:

After excluding lesions of the musculature or fascia, such as lumbago and diseases of the spine, like spondylitis, osteomalacia, etc., there is a wide range of possibilities in which nearly all the abdominal organs compete, including particularly the female generative system.

Some discredit has, I think, been attributed to Head's observations on the incidence and distribution of referred pain, by losing sight of the important fact that actual pain is not always experienced, but, "according to the intensity of the visceral stimulus, actual pain may be experienced, or there may result a state of hyperesthesia or hyperalgesia which manifests itself by an increased susceptibility to stimuli; so that contacts which would ordinarily evoke only sensations of touch now give rise to actual pain" (Schmidt). The observation that counterirritation applied over these cutaneous areas may result in relief of the pain and the underlying lesion throws a new light on the results, at times appearing to crown the arbitrary methods peculiar to osteopathy and other counterirritant curative agencies.

CONCLUSION

I believe that Pott's disease would be much more frequently and earlier diagnosed if its initial manifestations, of which pain in the form of backache is often conspicuous, were looked for and recognized.

Backache is of diagnostic value chiefly when unilateral and when guardedly controlled by some accompanying facts of diagnostic importance.

Familiarity with the work of Henry Head on the subject of pain, especially of referred pain, will often be found of the greatest help in reaching a correct and often a difficult diagnosis.

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THE CLINICAL INDEX OF THE THORAX ASSOCIATED WITH PULMONARY TUBERCULOSIS *

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Until very recently almost all text-books on medicine and physical diagnosis have described the thorax associated with pulmonary tuberculosis as flat, and even now some of them persist in this. For example, this statement appears in a recent edition, "The paralytic or phthisical chest is abnormally small, long and flat." This is a curious survival of a medical fallacy which apparently grew up simply because in the past no one had measured any considerable number of such chests. Most of them do appear to be flat, it is true, but taking measurements on a few will show that in most cases the flattening is not real and the appearance is an illusion. This is produced by the shoulders being displaced more forward and downward than normal, which makes the anterior surface of the chest appear to be displaced posteriorly—the type commonly called "round-shouldered" or "hollow-chested." There are two factors which tend to produce the displacement of the shoulders in this manner: (a) a more nearly round chest than the normal, and (b) relaxation or deficient development of the shoulder-girdle of muscles.

It remained for Hutchinson,¹ while engaged in a developmental study of the human thorax, to measure twenty tuberculous chests which he found to be more nearly round than the average normal chest. This he reported in 1897, and subsequent investigation convinced him that the average tuberculous chest is not abnormally flat, but is, on the contrary, abnormally round.

Measurements of the diameters of the chest are made on an imaginary horizontal plane passing through the junction of the fourth costal cartilages with the sternum. Dividing the anteroposterior diameter by the transverse diameter gives the ratio (usually expressed as a percentage) which the former bears to the latter, and is called the "clinical index" of the chest. Several thousand measurements taken at the Yale gymnasium and in the German army² place the average, normal, adult clinical index at 70 per cent., or 70 as it is usually expressed. There is evidently chance for a considerable degree of error in the procedure, as it is impossible to specify definite landmarks at which the measurements should be made, because of the varying degrees of tilting of the ribs found in different individuals. On the normal skeleton such a horizontal plane intersects the spine of the seventh dorsal vertebra, but this may occur

* Read before the Section on Medicine of The New York Academy of Medicine, April 20, 1909.

1. Hutchinson, Woods: Some Deformities of the Chest in the Light of Its Ancestry. *THE JOURNAL A. M. A.*, 1897, xxix, 512.
2. Hutchinson, Woods: Is the Consumptive Chest Flat? *THE JOURNAL A. M. A.*, 1903, xi, 1196.

at the sixth or the eighth in abnormal chests. At the midaxillary line the plane passes through the fifth interspace in normal chests, but it frequently intersects the fourth or sixth interspace in tuberculous chests. Errors also arise because of variability in the thickness of the integument in different individuals, and because of unequal amounts of pressure placed on the calipers in making the measurements.

Hutchinson's first series of 20 cases¹ of pulmonary tuberculosis representing all stages of the disease gave an average index of 78. He subsequently reported 350 cases collected by him from various observers which showed an average index of 79.7. Of these, 40 were of his own which averaged 79.5; 42 cases in the Brompton Hospital (England) averaged 79.6; 75 cases collected by Colbeck of London averaged 80.3; 42 of these were in the first stage and 14 were women which averaged 84.3; White of Boston had 35 cases, with an average of 77.9, of which 10 were women averaging 78.3; Evans and McHugh³ of Chicago had 107 cases averaging 80.8, and Abrams of San Francisco had 35 cases averaging 78. Bessesen⁴ has independently reported 21 men with incipient tuberculosis who gave an average of 74.2, and 6 women, also in the incipient stage, averaging 75.2.

This report is based on a study of 1,022 measurements made on tuberculous patients in the Bellevue Hospital Dispensary and the Cornell University Medical College Dispensary. About one-half of them were made by various physicians in the Bellevue Hospital Dispensary, and the remainder by myself. As the results obtained by the others almost exactly agree with my own, the element of personal error seems to be eliminated.

This series of cases occurred in several races and many nationalities, including both sexes and all ages from 8 to 84 years, in all stages of the disease. The average clinical index of all the cases (1,022) is 75.98. In order to remove all possibility of error from including normal infantile chests, I have excluded all under 20 years of age, leaving 929 patients aged 20 years or more, which gave an average index of 76. This is somewhat lower than the averages noted by other observers, except Bessesen, whose results closely correspond with mine. The difference is, in some instances, because the measurements were taken at the level of the nipples instead of at the junction of the fourth costal cartilages with the sternum, as done by Bessesen and in this series of cases. The highest index observed was 100. The patient was a woman, aged 44, who gave a history of cough for three months and was in the incipient stage. There were no signs of emphysema, except that her anteroposterior and transverse diameters were each 22 cm.

While the average clinical index of tuberculous chests is greater than normal, not every such thorax, by any means, gives a high index; 245 (24 per cent.) of my cases were below 70. This fact greatly limits the value of such measurements in the diagnosis of pulmonary tuberculosis. Finding a high index in an individual case may increase the suspicion of tubercle infection, yet the value of the evidence is so slight that it can have very little weight. The lowest index observed was on a

man, aged 39, who was in the second stage. His transverse diameter was 27.5 cm. and his anteroposterior 15 cm., giving an index of 54.4.

A considerable number of cases show indices which are exactly, or very close to, normal. Taking, for example, variations between 68 and 72, inclusive, I find that 219 (21 per cent.) come within these limits. There were, however, only 83 cases (8 per cent.) which were below 68, while 720 (70 per cent.) were above 72.

Sex is practically no factor in modifying the indices of tuberculous chests, as 808 males averaged 75.93 and 214 females averaged 76.16.

The question whether this increased index is the result of tuberculosis naturally arises. Hutchinson and Bessesen both concluded that it was not, and my findings tend to confirm this. If it develops because of changes in the lungs it is reasonable to conclude that the more extensive the pulmonary lesion the greater the resulting change in the thorax. Separating my cases into stages of the disease gives the following result:

Stage.	No. of Cases.	Average Index.
I	231	75.82
II	637	76.04
III	154	75.97

Though the average indices of the second and third-stage cases are slightly higher than that of the first-stage cases, the difference is so slight that it may be disregarded. The increase in index, then, is not in proportion to the extent of the pulmonary lesion and is, therefore, probably present before the lesion has developed in the lungs.

Classifying the cases by decades of life results as follows:

Decade.	No. of Cases.	Average Index.
1	2	84.50
2	91	74.40
3	311	74.62
4	354	74.43
5	190	80.50
6	63	77.82
7	10	77.40
8	1	79.00

The higher indices after the fourth decade are probably accounted for by the emphysema which normally develops with advancing years.

Some of the cases showed all of the signs of emphysema and consequently gave high indices. It was impossible, however, to exclude them, as one can not clinically decide how much is hypertrophic emphysema and how much is compensatory, having developed secondary to the tuberculous process. It is also unfair to exclude all indices above a certain point as being wholly due to emphysema, as some of the highest noted were on patients giving no signs of it; yet the fact remains that if it were possible to exclude all of those cases in which hypertrophic emphysema existed the average index of the series would be considerably lessened, certainly not above 74.5, which is the average index of the cases in the second, third and fourth decades, 756 in number.

What, then, is the cause of the abnormal relations of the diameters of the chest which exist in three-fourths of the individuals who later develop pulmonary tuberculosis? Hutchinson,¹ by a study of comparative and developmental anatomy, concluded that it was due to an arrest of development, and his conclusion seems to be well founded. With only two exceptions (whales and bats), all mammals below the anthropomorpha have chests which are deeper than they are broad; for example, horses, dogs and cats. They assume the horizontal position and are quadrupedal. It is evident that the chest best suited to their necessities is one which gives a maximum of room for expansion of the lungs without

3. Med. Exam. and Prac., 1902, xii, No. 10.

4. Bessesen, W. A.: Variations in the Ratio of Diameters of the Normal Chest at Different Ages. The Form of the Phtisical Chest, THE JOURNAL A. M. A., 1903, xiv, 2003.

compression of the heart and great vessels, and at the same time allows free movement of the forward limbs in running. This the deep or high-indexed chest gives. When, however, the forward limbs are not used for locomotion, but for climbing, swinging, defense and other lateral movements, the deep chest restricts the freedom of such motions, and the animal is better served by one which is more nearly round.⁵ The anthropoid apes are examples of this class; they assume the semierect position and in them "the thorax is rather broad than laterally compressed."⁶ In man, as has been shown, the thorax is normally flattened anteroposteriorly. Thus we see that in general as the mammalia ascend in the scale of development their chests become more flattened. The apparent explanation for the nearly round chests of whales and bats is that, as their anterior limbs are no longer used in ground locomotion, forward and backward movements, but laterally in swimming and flying, respectively, such a chest is best suited to their needs.

An examination of the human chest from fetal to adult life is of interest in this connection. At the fourth month of fetal life the chest is considerably deeper than it is broad—the lower mammalian type. During the later months the anteroposterior diameter relatively decreases until at birth the chest is practically round⁷—the anthropomorphical type; and after birth it gradually flattens out until the normal index of 70 is reached at about the eighteenth year. The period of most rapid change is during the first six years of life; and at puberty the index is about 80. It is evident, then, that each human chest in its development has gone through the same stages with respect to its diameters as has the human type in its ancestral development.

Having in mind the above, and that the type of chest in which tubercle infection most frequently develops is the same as the normal human chest at puberty, it is a fair conclusion that the typical tuberculous chest is one which has been arrested in its development at or about puberty. Bessesen⁴ believes that the lack of development is principally in the transverse diameter, the anteroposterior becoming about normal. High-indexed chests have been shown to be common among paupers and the insane,³ and a study of the literature and photographs leads me to believe that such chests may also be found associated with idiocy, cretinism and chondrodystrophy. High-indexed chests, then, are frequently associated with various forms of so-called degeneracy, which are really conditions of maldevelopment.

It has been suggested that the degree of abnormality in the diameters may have some influence on the prognosis of pulmonary tuberculosis, and Hutchinson⁸ states that in 31 successive cases, of 16 patients who did badly the average index was 80.2, while 15 that did well averaged 74.6. My observations regarding this have not been sufficiently extensive to warrant a conclusion, though a few cases have shown results which lead me to believe that it may be true.

If high-indexed chests predispose to pulmonary tuberculosis, it is possible to lessen this predisposition by exercises which tend to produce an increase in the trans-

verse diameter; such as climbing, swinging by the arms and movements laterally from the body. It also creates the presumption that it may not be best to prescribe for patients with pulmonary tuberculosis exercises which tend to develop deep chests.⁹

CONCLUSIONS

1. The typical tuberculous chest is more nearly round than the normal chest.

2. The increased index precedes development of tubercle infection in the lungs. It is due to an arrest of development at or about puberty and predisposes to pulmonary tuberculosis.

3. Abnormally high-indexed chests in children should be corrected by proper exercises.

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CHLOROFORM—THE IDEAL HEMOSTATIC IN PULMONARY HEMORRHAGE

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In spite of the great advance made in medicine during the last half-century, the treatment of pulmonary hemorrhage remains practically the same as at the time of Galen, with the addition only of a number of the newer drugs which do not seem to materially improve the solution of this vexed question. The therapeutics of this frequent complication in pulmonary tuberculosis is still based entirely on clinical experience, which in the main is unsystematic and haphazard. Morphin, atropin, ergot, hydrastis, lead acetate, stypticin, adrenalin, calcium chlorid, gelatin, nitrites, magnesium sulphate, and a host of other drugs used either singly, in combination, or in rotation, are doled out to the patient with more or less disappointment until Dame Nature, in spite of the drugs and the deranged digestion resulting from their employment, comes to the sufferer's rescue and by her *vis medicatrix* brings about the formation of a blood clot at the bleeding point.

The lot of a patient afflicted with pulmonary hemorrhage is, indeed, pitiful and his aspect at once evokes compassion. Compelled to lie flat on his back without even a pillow under his head, enjoined from changing his position, or at times even his clothes, no matter how irksome or oppressive, forbidden to turn his head or utter a word, subjected to the inevitable ice-bag, which occasionally leaks and chills him to the bone, stuffed with cracked ice in lieu of food, given frequent hypodermic injections, the patient must needs look very forlorn and think of naught but his impending doom. Nor is the position of the attending physician an enviable one, harassed as he is by anxious relatives and uncertain as he must be as to the results of his treatment.

In a previous paper¹ I made cursory mention of the successful use of chloroform in the treatment of pulmonary hemorrhage. Since that time I have continued my experiments with the drug and have given up one by one almost all the above-mentioned medical agents, limiting my treatment even in very severe hemorrhages to chloroform only. I am happy to report most excellent results from the use of chloroform in nineteen

5. Hutchinson: Studies in Human and Comparative Pathology, 1901, Chapter v.

6. Huxley: Anatomy of Vertebrate Animals, p. 402.

7. Holt: Diseases of Infancy and Childhood, 1908, p. 24.

8. Hutchinson, Woods: Discussion on Dr. Bessesen's paper, THE JOURNAL A. M. A., 1905, xlv, 2007.

9. Med. Rec., 1905, lxxvii, 645.

1. Clinical Observations on Pulmonary Hemorrhage, THE JOURNAL A. M. A., March 13, 1903, 883.